Warm-Up!

The manager of 3 vacation condo resorts wants to see how much money he can take in by renting all of his condos for one week. 2-bedrooms rent for $1700 for the week, 3-bedrooms for $2000 and 4-bedrooms for $2500. Write a matrix to represent the number of each type of condo at each resort and a matrix for the rental cost for each. Then calculate the total rent generated in one week, at each condo, if everything is rented.

	2-bedroom	3-bedroom	4-bedroom
Sunny Side	30	25	20
Beach Comber	15	40	10
Surfs Up	40	45	15

$\begin{bmatrix} 30 & 25 & 20 \\ 15 & 40 & 10 \\ 40 & 45 & 15 \end{bmatrix} \begin{bmatrix} 1700 \\ 2000 \\ 2500 \end{bmatrix}$

4-5 Determinants

The determinant of a matrix is a value of a square matrix that will be used to:

- calculate the inverse of a matrix
- solve systems

• area of polygons

2x2 Matrix (2nd order determinants)

The determinant, D, is calculated as follows:

$D = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

ex:

$\begin{vmatrix} 5 & 10 \\ 8 & -3 \end{vmatrix} = -15 - 80 = -95$

matrix

Calculate determ.

ex:

$\begin{vmatrix} -2 & 6 \\ -5 & 1 \end{vmatrix} = -2 - -30 = 28$

ex:

$\begin{vmatrix} 4 & 10 \\ 2 & 5 \end{vmatrix} = 20 - 20 = 0$

ex:

$\begin{vmatrix} 4 & 6 \\ x & 12 \end{vmatrix} = 12$

$48 - 6x = 12$

$-6x = -36$

$x = 6$

3x3 Matrix (3rd order determinants)

Befor calculating the determinant, D, we must define a minor.

Minor--of an element in a determinant is the determinant resulting from the deletion of the row and column containing the element.

ex:

$\begin{vmatrix} 5 & -1 & -2 \\ 3 & 6 & -7 \\ 2 & -3 & 4 \end{vmatrix}$

The minor of 5 is: $\begin{vmatrix} 6 & -7 \\ -3 & 4 \end{vmatrix}$

The minor of 6 is: $\begin{vmatrix} 5 & -2 \\ 2 & 4 \end{vmatrix}$

The minor of -7 is: $\begin{vmatrix} 5 & -1 \\ 2 & -3 \end{vmatrix}$

Evaluate the determinant, using expansion by minors.

ex:

$$\begin{vmatrix} 5 & -1 & -2 \\ 3 & 6 & -7 \\ 2 & -3 & 4 \end{vmatrix}$$

$= 83$

$5\begin{vmatrix} 6 & -7 \\ -3 & 4 \end{vmatrix} + 1\begin{vmatrix} 3 & -7 \\ 2 & 4 \end{vmatrix} + -2\begin{vmatrix} 3 & 6 \\ 2 & -3 \end{vmatrix}$

$21 \quad -14 \quad 12$

$3 \quad 24 \quad 12 \quad -21 \quad 9$

$15 + 26 + 42$

$= 83$

$$\begin{vmatrix} + & - & + \\ - & + & - \\ + & - & + \end{vmatrix}$$

Evaluate the determinant, using expansion by minors.

ex:

$$\begin{vmatrix} 2 & -1 & -6 \\ 3 & 4 & 2 \\ 5 & -2 & 3 \end{vmatrix}$$

$-\,-1\begin{vmatrix} 3 & 2 \\ 5 & 3 \end{vmatrix} + 4\begin{vmatrix} 2 & -6 \\ 5 & 3 \end{vmatrix} - -2\begin{vmatrix} 2 & -6 \\ 3 & 2 \end{vmatrix}$

$10 \quad -30 \quad -18$

$-1 \quad 9 \quad 36 \quad 6 \quad 22 \quad 4$

$-1 + 144 + 44$

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Evaluate the determinant, using expansion by minors.

ex:

$$\begin{vmatrix} 5 & 2 & 34 \\ -1 & 3 & 22 \\ 0 & 0 & 4 \end{vmatrix}$$

$+0\begin{vmatrix} & \end{vmatrix} - 0\begin{vmatrix} & \end{vmatrix} + 4\begin{vmatrix} 5 & 2 \\ -1 & 3 \end{vmatrix}$

$-2 \quad 17 \quad 15$

$= 68$

Expansion by minors works for any higher order determinant as well.

ex:

$$\begin{vmatrix} 1 & 2 & 1 & 0 \\ 3 & 2 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2 \end{vmatrix}$$

hw

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